Military Infectious Disease Research — Preventing Debilitating Disease and Developing Response Strategies

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The U.S. Army Medical Research and Materiel Command's (MRMC's) Military Infectious Disease Research Program (MIDRP) focuses on prevention, diagnosis and treatment of diseases that can seriously hamper military mobilization, deployment and effectiveness. MIDRP's 330 scientists have military, civil service or commercial experience and leverage their research dollars by collaborating with industry and academia through more than 100 cooperative research and development (R&D) agreements.

CPT Keith Blout, an entomologist deployed with the 332nd Expeditionary Medical Group at Tallil Air Base in Iraq, sorts sand flies and mosquitoes for analysis. He examines the sand flies to identify the DNA of parasites that cause cutaneous leishmaniasis, which causes skin sores. (U.S. Air Force photo by MSGT Lance Cheung.)

MRMC MIDRP products include licensed vaccines for hepatitis A, Japanese encephalitis, typhoid fever adenovirus, meningococcal meningitis, rubella and influenza. Malaria still causes more than 1.5 million deaths per year worldwide. Military infectious disease researchers have played significant roles in developing all synthetic antimalarial drugs licensed in the United States. Many of these drugs are used around the world by militaries and civilians to prevent and treat malaria infections.

MRMC researchers have also developed the current dosing regimen for treating cutaneous leishmaniasis with the drug pentostam. Leishmaniasis infections resulted in a battalion-sized loss of combat strength during the first phase of *Operation Iraqi Freedom*. The program has developed other innovative products, such as a DEET-based standard insect repellant and a camouflage face paint insect repellant for protecting servicemen and women from disease-spreading insects.

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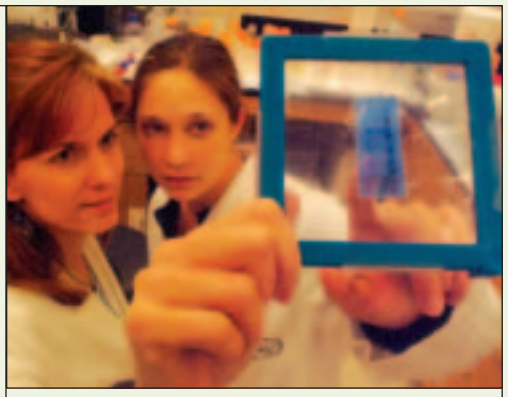
MRMC Research in Kenya

MRMC's OCONUS laboratories such as the U.S. Army Medical Research Unit-Kenya (USAMRU-K) are valuable resources in this program's global approach to protecting warfighters from infectious disease threats. The program, conducted under a cooperative agreement with the Kenyan government, funds eight infectious disease research laboratories, accredited animal lab facilities, biosafety containment labs, a pilot vaccine facility and clinical trial units. USAMRU-K's mission is to develop and test improved means for predicting, detecting, preventing and treating infectious disease threats to the African people. USAMRU-K's primary objectives are to help develop and test malaria and human immunodeficiency virus (HIV) vaccines, as well as antimalarial drugs. USAMRU-K is one of two principal overseas commands that conduct research in tropical infectious disease. Major efforts are summarized below.

Kenya-Kowemba Clinic, site of the USAMRU-K Malaria Immunology Program. (U.S. Army MRMC photo.)



WRAIR researchers Lisa Ware (left) and Sally Robinson examine a malaria vaccine antigen. (Photo courtesy of the U.S. Army Medical Command.)

One such USAMRU-K initiative is in malaria immunology research. The Malarial Immunology Program's mission is to test and develop drugs and vaccines for the prevention and treatment of malaria and to increase our understanding of how malaria causes death and disease by studying semi-immune and nonimmune populations in malaria-endemic areas. The program relies heavily on funding from partnerships between DOD, nonprofit organizations such as the Malaria Vaccine Initiative and industrial partners such as Glaxo-SmithKline. The Malaria Pathogenesis program in immunology is intended to provide a better understanding of the pathogenesis of severe malarial anemia and cerebral malaria, two of the deadliest complications of P. falciparum malaria. A major area of research is in the role of red cell complement regulatory proteins and complement in the pathogenesis of these two conditions. The program is supported by grants from the National Institutes of Health (NIH), the Fogarty International Center (FIC) and the World Health Organization (WHO).

Antimalarial R&D Leads to New Agents

The Malaria Drug Screening Laboratory conducts research aimed at malaria drug discovery and drug resistance. Malaria drug discovery efforts currently test natural products — both as

Army and international scientists, doctors and researchers are actively conducting screening and prevention programs in Kenya, Nigeria, Cameroon, Uganda and Tanzania to develop more effective vaccines against HIV and malaria. (U.S. Army MRMC photo.)

plant extracts and purified compounds — for their ability to kill the malaria parasite in culture. These efforts may identify natural products that can be transitioned into advanced development as a new antimalarial drug. The Molecular Malaria Laboratory conducts scientific research into drug-resistant molecular mechanisms. This program is supported by grants from NIH, FIC and WHO.

Strategies to Prevent HIV Infection

USAMRU-K conducts research to develop and test vaccines based on the genetics and subtypes (clades) of the viruses prevalent in this region, to help develop HIV vaccines. Clinical testing of vaccines in Africa will permit evaluation of the role clades A, C and recombinants have in varying proportions to the HIV epidemic. Current research projects include:

- Estimating the incidence and prevalence of HIV.
- Characterizing the risk factors associated with HIV infection.
- Determining the viral clade and recombinations of HIV-1 in Kenya.
- Characterizing the kinetics of HIV-specific immune responses, CD4 counts and viral loads in early HIV infection and in the face of malaria co-infection.

USAMRU-K is the primary field station for the U.S. Military HIV program and provides regional coordination between our programs in Uganda, Tanzania, Cameroon, Nigeria and Kenya. In addition to conducting research, USAMRU-K also sponsors HIV prevention programs.

Global Emerging Infection Surveillance (GEIS)

The GEIS project at USAMRU-K will provide a dynamic public health surveillance system to address all of DOD's GEIS mission needs, emphasizing diseases that are uniquely suited to study in sub-Saharan Africa. USAMRU-K has developed and established a robust infectious disease surveillance program consisting of well-equipped and staffed international surveillance sites, capable central laboratory facilities, a strong educational program and dedication to infrastructure development within our host nations. The GEIS project will allow collection, analysis and dissemination of data in near-real-time.

MRMC is pursuing a broad range of research into prevention, diagnosis and treatment of infectious diseases, both at home and abroad. USAMRU-K is the only DOD infectious disease laboratory in sub-Saharan Africa. It is uniquely positioned to test improved products for the diagnosis, treatment and prevention of infectious disease threats to deployed service members. It also undertakes surveillance activities to identify and develop response strategies for emerging infections that have the potential to disrupt military readiness. Collaborations with host nation institutions and with regional medical resources are key to this mission's success.

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